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ABSTRACT

Research into brain physiology and dream psychology have helped to illuminate the biological purposes and processes of dreaming. Physical and functional characteristics shared by dreaming and television include the perception of visual and auditory images, operation in a binary mode, and the encoding of visual information. Research is needed in the following areas: the effects of heavy television viewing on the brain's internal scanning mechanism or firing pattern; the effect of exposure to television's heavily saturated, luminous colors on the colors experienced in dreams; the relationship between experiences in dreaming and viewing by comparing electroencephalographic recordings during rapid eye movement (REM) sleep and during television viewing; the capability of television viewing to stimulate a mental state between waking and dreaming; the relationship between perceptions in dreams and on television and its implications for visual literacy; comparison of dream content to television content; the formulaic, cyclical nature of dreaming and of television programming; and the possibility that television is capable of bypassing conscious processing and implanting images directly into the unconscious. (DF)

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TWO DREAM MACHINES: TELEVISION AND THE HUMAN BRAIN

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TWO DREAM MACHINES: TELEVISION AND THE HUMAN BRAIN

> Art and Science may not be two simultaneous and parallel ways of knowing, but art and science may be, and in that order, two successive moments of any truly human knowledge.
> --John Dominic Crossan (1975, p. 26)

In The Dark Interval (1975), John Crossan disputes what he calls the three master-claims of the Western world. He questions the superiority of scientific language over creative language, the inevitability of progress, and the master-claim that "there is an external reality out there extrinsic to our vision, our imagination, and our intellect that we are gaining objective knowledge and disciplined control over this extramental reality" (p. 19). Crossan challenges all three postulates in his thesis "that art and science, or poetic intuition and scientific achievement, are not two simultaneous and separate ways of knowing but two successive and connected moments of all human knowledge; that there is continual evolutionary change but no overall evolutionary progress; and that 'reality' is the world we create in and by our language and our story so that what is 'out there,' apart from our imagination and without our language . . . is unknowable" (p. 40).

Crossan, a theologian, cites no psychophysiological research on the function of the human brain or perceptual systems. With or without his awareness (or approval), however, the conclusions of the humanist are supported by the observations of empiricists, particularly those who have been engaged in studies of hemispheric

asymmetry in the brain, but also by students of perception and dreaming. This paper explores some connections between physiological and psychological--mechanistic and humanistic--understandings of human information processing. More specifically, this analysis concerns the physiology and psychology of dreaming and how concepts from those disciplines shed light on the role of television in human fantasy life. But perhaps of greater ultimate significance is a fringe benefit of such an endeavor, the realization that behaviorism and humanism need not be incompatible ways of understanding human experience.

The Biological Dream Machine

The mechanistic approach to the brain and its functions is founded on the premise that all mental activities are consequences of anatomy and physiology alone. This view assumes that consciousness and unconsciousness are passive phenomena; that is, phenomena automatically produced when specific groups of neurons in the brain are activated. Thus, in the words of Dean Wooldridge (1963, p. 239), consciousness itself is regarded as a "natural phenomenon suited to being described by and dealt with by the body of laws and methods of the physical sciences." The "bionic" (to use a term from television) implications of the mechanical model are obvious. Indeed, in more than one sense, the synthetic "mind" may be the ultimate consciousness in that there can be no mysteries about its functioning. The natural urge to endow

the computer with mysterious and inaccessible powers thus beaten back, it becomes possible to apply the cybernetic analogy (and the terminology of information science) to the brain.

The computer was born out of the need for extrasomatic devices to extend human information processing and storage capabilities beyond the limits of the nervous system in general and the brain in particular. As information systems, the brain and the computer share three aims: maximum information processed in minimum time and stored in minimum space. The brain, which as R. L. Gregory (1973, p. 67) describes it, in appearance resembles nothing so much as "a lump of porridge," is a network of neurons whose traffic is electrical pulses. Its basic mode of operation is binary, with the sense receptors serving as encoding terminals that convert light, sound, tactile, and olfactory sensations into a code of modulated pulses. Concepts of memory, feedback, monitors, entropy, noise, and redundancy are applied to the functioning of the brain as easily. Examples of such applications from various scientific disciplines include Gregory (1973), Wooldridge (1963), Wright (1964), Eccles (1977), Heller (1955), and Sagan (1977).

The human brain contains two asymmetrical hemispheres, whose asymmetry appears to be "hard-wired" rather than learned. The left, or dominant, hemisphere contains the speech centers in almost all (95-98%) humans. The asymmetry is peculiar to

humans and has been detected even in fetuses (Eccles, 1977, p. 207). Eccles and others surmise that the neuronal structure of the speech areas is specialized for the unique coding and decoding of linguistic performance. The right hemisphere is responsible primarily for spatial construction, simple language comprehension, and nonverbal ideation (Sperry, 1968).

Communication between the hemispheres occurs through the corpus callosum, a bundle of about two hundred million fibers firing at an average frequency of twenty impulses a second with the capacity for four billion impulses a second (Eccles, 1977, p. 209). Because it lacks the speech capacity, the right hemisphere is always, so to speak, unconscious, relying almost exclusively upon the corpus callosum for linkage to the articulate, conscious self. Eccles (1977, p. 221) summarizes the performance of the two hemispheres as follows. The dominant hemisphere is responsible for liaison to consciousness, verbal behavior, linguistic description, ideation, conceptual similarities, analysis over time, analysis of detail, arithmetical and computer-like functions. The minor hemisphere has no such liaison to consciousness, is almost nonverbal, and is responsible for musical, pictorial and pattern sense, visual similarities, synthesis over time, holistic perceptions, images, geometrics and spatial functions. Like the computer, the brain is capable of carrying on separate operations simultaneously, as evidenced by the parallel processing carried on

by the various perceptual systems and by the conscious and unconscious minds (Jaynes, 1976, p. 392).

Having summarized the highlights of the cybernetic analogy, I am obliged to mention two pitfalls inherent in it. First to return to Gregory's lump of porridge, the brain's functions are not easily deduced from its structure. Unlike the mechanical systems, in which the bones of the limbs resemble the levers that they are, the brain's functions are not evident in its visible structure. Rather as Gregory (1973, p. 67) suggests, we must deduce functions from design principles of the system. Any mechanical model, including the computer, is drastically simpler than the brain, whose intermixture of analogue and digital operations still contains many secrets. Some features of the cybernetic analogy are metaphoric, and they should not be mistaken for literal correspondence.

On the other hand, our knowledge of specific brain structures and their functions now is increasing at a considerable pace. For example, Mishkin (1978) and his colleagues from the National Institutes of Health recently reported that they have succeeded in mapping the entire visual system--from stimulus, to analysis, to reaction--at work in monkeys. Pursuing work begun by Olds, Routtenberg (1978) and his associates at Northwestern University have traced the brain's reward system from the forebrain pleasure centers Olds discovered to areas deep in the brain stem and far forward in the cortex of the frontal lobe of the cerebrum.

Using histofluorescent micrographs of brain tissue to reveal anatomical locations of chemical substances, Routtenberg has charted the brain pathways of self-stimulation as explicitly as well-known sensory and motor systems have been charted in the past. Research such as the two examples cited relies heavily upon the use of the computer.

A second pitfall in the application of the cybernetic analogy to the human brain is inherent in the proven usefulness of the analogy. The existence of the computer and the application of systems analysis to the brain have accelerated learning about the brain impressively. The cybernetic analogy is so appealing, however, that the temptation is to be satisfied with it, convincing ourselves that the appropriate model for that reality "out there" has been found. Because any theory and the language it uses are value-laden, the theory to some degree shapes the reality it aims to describe. Failing to nurture healthy skepticism, then, we put ourselves in danger of becoming a closed system, as it were, incapable of receiving new input and subject to uncontrolled entropy.

With these caveats dutifully spoken, I will now embark on the review of dreams from the mechanistic point of view. Exercising the cybernetic analogy, Dewan (1967) offers the hypothesis that the purpose of sleep is to program or reprogram the brain. Extending this hypothesis, Dewan sees dreaming as the sorting (or addressing) of memories, as well as motor and perceptual

sub-routines with respect to drives and goals by using labels provided by feelings associated with the memories. Breger (1967, p. 19) sees dreams as "one output of particular memory systems operating under the guidance of programs peculiar to sleep." Other outputs listed by Breger are images, thoughts, and feelings, and "a variety of psychophysiological reactions. The quality of dreams, that is, their creative and sometimes bizarre nature, is due to the special programs guiding the internal transformations and output of the memory systems during sleep."

Laying the analogy aside for a moment, let us get specific about the physiological characteristics of dream sleep, which, as Snyder (1967, p. 59) indicates, is "a very old and basic biological characteristic of mammalian life." Jones (1978, p. 119) proposes that dreams be viewed as the "augmentative response of the human psyche to the distinctive neurophysiological conditions of the mammalian D-state." The physiological characteristics of the dream state as summarized by Jones (1978, p. 1) are:

> (1) rapid conjugate eye movements, (2) a distinctive low voltage desynchronized cortical EEG pattern, (3) increased variability in respiration rate, (4) increased variability in pulse rate, (5) increased blood pressure, (6) decreased muscle tonus, (7) high brain temperature and metabolic rate, (8) increased variability in arousal threshold, (9) full or partial penile erection in males, and (10) dreaming.

Electrically, Rapid Eye Movement (REM sleep), or desynchronized (D-state) sleep, is as different from non-REM sleep as it is from

the waking state, a distinction which leads to its designation as the third basic form of human existence.

Electroencephalagraphically, wakefulness is characterized by the production of alpha waves. Non-REM sleep, or "thinking sleep," is characterized by rhythmic variations around a reasonably stable base line. REM sleep is much more erratic. Snyder, Hobson, Morrison, and Goldfrank (1964, p. 421) concluded from measurments of systolic blood pressure, respiratory rate, and pulse rate that non-REM sleep reflects "a continuous interplay of homeostatic compensations in a vegetative system. The changes seen during REM sleep are entirely different in that they take the form of unpredictable fugues of erratic and often marked change, presumably reflecting the same sort of activation in discrete physiological systems as do the bursts of eye movements" that give REM-sleep its name. The intense and erratic electrical and physiological activity that accompanies (or is) dreaming occurs about every ninety minutes through a period of sleep and lasts for increasingly longer time periods, ranging from about five minutes to about forty-five minutes, the longest period occurring when the body is most fully rested and about to re-enter the waking state.

In the brain itself, dreaming assumes a sensory quality due to the formal characteristics of a dream. These characteristics are noted by Ullman (1962, p. 19):

> At the time the dream is occurring the brain is in a state of partial arousal in response to the initial corticopetal impulses mediated through the reticular activating system; and its efferent system is oriented not to somatic efferents mediating activity in the external world, but to corticofugal efferents to the reticular system influencing the threshold in that system. The cortex in this sense becomes another source of afferent stimuli feeding into the reticular system, along with all the other afferent stimuli impinging upon this system. It is in conjunction with this mode of functioning, namely, where the cortex provides a source of afferent stimuli, afferent to the reticular activating system, that the formal characteristics of the dream assume an afferent or sensory quality.

Because these internal stimuli are coded in the same language as inputs from the external world, the reticular activating system responds to them in the same way as it does to sensory data. This accounts for the vivid sensory quality of dreams as they are experienced by the dreamer.

Experientially, dreams consistently manifest certain characteristics. They are primarily visual experiences created by neural activity encoded to represent objects and patterns. The complexity of this encoding is staggering when one considers that tens of millions of nerve cells are involved in recalling even the simplest memory, the engram (Eccles, 1977, p. 202). It is no wonder that it requires an impressive electrical storm to create the immensely varied visual experiences to which we are treated nightly. Dreams are experienced in color, a phenomenon which accounts for some of the encoding complexity.

In dream, experience is concrete, objects being wholly particular and not representative of categories; and they are experienced in action (Jones, 1978, pp. 153, 166). Dreams range from the highly dramatic to the prosaic. Laboratory studies (Hall & Van de Castle, 1966, and Snyder, Karcan, Tharp, & Scott, 1967, for example) in which subjects are awakened from the D-state and asked to recall their dreams show a preponderance of the latter. Jones (1978) suggests that the preponderance of boring dreams in the laboratory may be attributed to the fact that laboratory subjects recall almost all of their dreams (up to 90%), while under normal circumstances they remember only the most dramatic dreams, which may or may not be fewer in number. In any case, dream recall fades quickly. In the laboratory, researchers have a maximum of ten minutes after a period of REM-sleep to awaken a subject to get a report of dream recall (Dement & Wolpert, 1958).

Dreams occur in sequences and tend to be formulaic in design. Trosman, Rechtschaffen, Offenkrantz, and Wolpert (1960), for example, collected 106 dreams from two subjects in the course of thirty-two nights. One conclusion of the study was that "a direct relationship among the manifest contents in the dreams of a night was rarely noted. However, the appearance of unique elements at similar points in a sequence, the lateral similarities of events from night to night and the confluence of similar dimensions suggest an organization of manifest contents into

regular patterns" (p. 606). The same researchers noted that cycles of latent content accompanying recurrent discharges of excitement in "a highly dramatic visual representation" occurred with "striking regularity."

Finally, dreams exercise the brain's right hemisphere. In D-state sleep, the left hemisphere (which dominates human activity in the waking and non-REM states) is either suppressed or occupied with tasks (such as data dumping and addressing) that make it inaccessible to consciousness. That the right hemisphere is capable of the complexities of dreaming described above has been well established. On the subject of access to the right hemisphere in patients in whom the corpus callosum has been severed to control epilepsy, Eccles (1977, pp. 217-18) concludes:

> The right hemisphere is a very highly developed brain except that it cannot express itself in language; it is not able to disclose any experience of consciousness that we can recognize. [R. W.] Sperry postulates that there is another consciousness in the right hemisphere, but that its existence is obscured by its lack of expressive language. On the other hand, the left hemisphere has a normal linguistic performance so it can be recognized as being associated with the prior existence of the ego or the self with all the memories of the past before the commissural section. On this view there has been split off from the talking self a nontalking self which can't communicate by language, so it is there but mute, or aphasic.

Whether the active dominant hemisphere of the waking state (the analytical, linear-processing, left hemisphere) suppresses the fantastic, synthetical, simultaneous-processing right hemisphere

because it is incapable of linguistically encoding the right hemisphere's experiences, or because the intense and erratic brain-wave activity of the right hemisphere in dreaming would simply overload the left hemisphere's circuitry, is not known. In dreams, however, the so-called minor hemisphere seems to have free rein to do its work, and, in Sagan's (1977, p. 145) words, "the gazelles and dragons begin to stir."

Regarding the biological purpose of dreaming there is less agreement than there is about the process of dreaming. Speculations as to the purpose of dreams include Dement's (1964) idea that one purpose might be that of clearing the nervous system of an endogenous metabolite deposited by daily activities, Weiss's (1966) notion that the D-state may serve to reorganize neuronal firing patterns disorganized during sleep, and Ephron and Carrington's (1965) suggestion that dream sleep provides opportunities for recovery from the sensory deprivation of sleep (a homeostatic function). Berger (1969) suggests that the D-state provides a mechanism for establishing neuromuscular pathways serving binocularly coordinated eye movements. This mechanism periodically innervates the oculomotor system in order to maintain binocularly coordinated eye movement in subsequent wakefulness.

Roffwarg, Muzio, and Dement (1966) have argued that dreaming provides a source of endogenous cortical stimulation in order to supplement the inadequate sensory stimulation received in the brief waking periods of fetuses and infants. It is clear that the

D-state has some developmental function because children spend far more time in the D-state than do adults. Infants spend approximately fifty per cent of their sleep-time in the D-state. This percentage decreases until, by the age of sixty, humans spend only about fifteen per cent of their sleep-time in the D-state (Jones, 1978, pp. 26-27).

Research into the biological processes of the D-state continues, though empirical connections between the biology of dreaming and the psychology of dreaming are not firmly established. Adapting Lewin's notion of the "dream screen," Snyder (1969, p. 24) summarizes the state of affairs in dream research:

> I can conceive that in some sense the primitive biological process of the REM state periodically provides the "energy" to illuminate the screen as well as the projector mechanism to crank the film, and possibly the film itself; but that, for reasons we cannot yet comprehend, all of this would go on regardless of whether the film contained the meaningful images we call dreams. For physiological answers to such questions as how the scripts of dreams are written, or the film produced, or why the entire process takes place, we can only wait hopefully and expectantly, but still very much in the dark.

Despite recent developments such as Hobson and McCarley's (1977) location of the reticular formations that orchestrate forebrain activation, blockading of outside input, motor input, oculomotor activity, and provision of the forebrain with neurologically generated information, precise connections between neurobiological activity in the brain and dream content are yet to be established.

Nonetheless, Jones' (1978, pp. 130-31) synthesis of biological and psychological functions leads him to the reasonable suggestion that during sleep the conscious mind, relieved of extrapsychic suggestion, is obliged (for whatever reason) to attend the intensified intrapsychic activity of the D-state, an idea which accounts for the hyperconscious quality of dreaming and for its "peculiar admixture of discursive and presentational symbolic forms."

To put such an idea into the context of hemispheric asymmetry, we might say that the conscious, verbal, rational left hemisphere is influenced by the unconscious, visual, intuitive, right hemisphere much more intensely, or at least more overtly, in the D-state than it is in the waking state. Of course, even in a waking state, the left brain needs the right brain for what Nebes (1977, p. 104) describes as "the neural basis for our ability to take the fragmentary sensory information we receive and construct from it a coherent concept of the spatial organization of the outside world--a sort of cognitive spatial map by which we plan our actions."

Jerome Bruner (1962) characterizes this relationship as the left hand (controlled by the right hemisphere) teaching the right hand (controlled by the left hemisphere), or intuition proposing things that the reason may test. More recently, Jaynes (1976) has argued (from a very different point of view) for the importance of the sense of visual space to consciousness, calling it "the very rich ground and fabric of consciousness" (p. 269).

The creative process often is described as having three basic stages. Two of these stages are intensely conscious, characterized by Ghiselin (1952) as preliminary labor without which significant creative activity cannot occur, and the stage of verification, correction, and revision that completes or refines the newly creative product. In between these conscious stages, creativity requires accession to the unconscious. The actual process of reasoning requires what Jaynes (1976, p. 44) calls "the dark leap into huge discovery, . . . almost as if the problem had to be forgotten to be solved." This familiar experience, recounted by Einstein, Kekule, Melville, Conrad, and other recognized geniuses, underscores the importance of right-brain processing, whether accessed in dreams or in some other state, to the achievements of consciousness.

The necessity of directly accessing the right hemisphere's perceptions has significance beyond creativity, however. Consciousness, the filterer, translator, and evaluator of experiences (including ideas) is heavily conditioned by culture, especially by language. Consciousness is dominated by system; it is orderly, secure, comfortable, especially to the western mind. The categories out of which we build our reality systems (and languages) themselves create that reality in large measure.

The human inability to perceive external reality directly is not a tenet maintained solely by theologians such as Crossan.

Eccles' (1977) concepts of primary and secondary realities bear this out. Eccles, with Karl Popper, has identified three worlds of existence: World 1 is made up of physical objects and states, World 2 of states of consciousness (including inner and outer sensing), and World 3 of knowledge in the objective sense (cultural heritage--including language and theoretical systems--coded on material substrates). Eccles argues that World 2 is our primary reality. World 1 is a secondary reality accessible to us only through our perceptual and thought processes (World 2). We gain access to World 3 via education, a process by which the system created for us by our perceptual limitations is further refined.

Physiology and culture both abstract experiences by providing categories and paradigms for dealing with reality. Biologist Gunther Stent (1972) describes the successive abstractions of raw data by the visual system. Information reaches consciousness not as raw data but as highly abstract structures that are the result of a preconscious, step-by-step transformation of sensory input. Before data reaches consciousness, they are "selectively destroyed" in the abstraction process. Meaning, therefore, is the result of the transformation of data into a pattern that matches a pre-existing mental structure. Stent notes that similar conclusions were reached by structuralists (Jung, Kohler, Chomsky, and Levi-Strauss) entirely from the study of human behavior, conclusions that are now confirmed by physiological research.

Taking the principle a step further, Jaynes (1976, p. 398) goes so far as to assert that consciousness itself is culturally

learned, arriving at this conclusion through a review of research on both hemispheric asymmetry and hypnosis. If Jaynes is correct, then the direct accessing of the unconscious (or the right hemisphere) in the D-state is all the more significant, for it is in this state that we experience the fantasies that we translate into new symbols. Without dreaming, we would be totally trapped in a reality that is linguistically, and thereby, culturally, determined.

Thus we have returned to the ideas with which this paper began. Incapable of directly experiencing the world, we--through physiology and acquired habit--create the world. This world of our own making is the world in which we dwell. To quote Crossan (1975, p. 37):

> Reality is neither in here in the mind nor out there in the world; it is the interplay of both mind and world in language. Reality is relational and relationship. Even more simply, reality is language. What is there before us and is without language is as unknowable as the answer to the question of how we would feel had we never been born. The Bible suggests (one of its less happy suggestions) that we go to the ant and learn its ways. A better suggestion would be to go to the spider and study its destiny and ponder how it weaves a web from inside itself and then dwells in it and calls it world (I suppose). All of which means we had better take language very carefully and treat our poets very seriously.

I would add that we need to take television very seriously for reasons delineated below.

The Electronic Dream Machine

Dreams and television share two characteristics that work against their being taken seriously. For one thing, both are so familiar, so commonplace, that it is easy to take them for granted. For another, the content of both dreams and television programs is easy to regard as mere fantasy or escapism, pejoratives that are particularly effective for triggering guilt in Americans. Psychiatrists (who take dreams more seriously than most people do) are among the most vituperative critics of television. Their concern implies that they take television very seriously. Why else would they expend so much energy denouncing it? To those readers who are ready with an assortment of answers to my question, let me say that for the purposes of this paper I am assuming such criticism to be honorably motivated.

My intent in the analysis which follows is to draw a number of parallels between dreaming and television that may prove to be worthy of investigation. If drawing together a few physical and functional characteristics of the two dream machines and their products does no more than connect a little science with a little art, this effort is not in vain.

Like dreams (defined as responses to the neurophysiological conditions of the D-state), television's pictures and sound are subject to the laws of physics. The images we see and hear on television are the result of sensory reception and processing of

physical stimuli (both by the camera and by the viewer). Dream images are the result of similar processing of internal stimuli that may or may not have extramental origins. Both dreams and television, therefore, result in the perception of visual and auditory images.

In each system, images are built from the traffic of electrical pulses through the system's circuitry. Thus both systems operate in a binary mode. Currently, both television and dream systems are a blend of analogue and digital functions, though there is every reason to believe that several of television's analogue functions will be replaced with digital ones in the near future. For example, digital tuning already is available in several receiving sets now on the market.

The encoding of visual information in the two systems also is similar. In both cases, encoding terminals (the eyes and the camera) translate patterns of light reflected from objects into modulated electrical current. In the television camera, the visual data are focused onto a light-sensitive surface that is systematically scanned by an electron beam. In the human visual system, the incoming data are fixed on the retina. When an image is stabilized, the perception of it fades in a few seconds. According to Gregory (1973, p. 44), part of the function of saccadic [jerking] movements of the eyes is "to sweep the image over the receptors so that they do not adapt and so cease to signal to the brain the presence of the image in the eye."

The rapid eye movements of D-state sleep are related to the saccadic eye movements of waking perception. Whether as a compensatory device for sensory deprivation or as a mechanism for the maintenance of the neuromuscular pathways necessary for binocular vision (Breger's [1967] hypothesis), the brain's scanning mechanism clearly is at work during dream sleep. The possible effects of heavy television viewing (during which the viewer is exposed to the scanning raster and firing patterns of television) upon the brain's internal scanning mechanism or firing patterns makes for intriguing speculation.

Equally intriguing is the possibility that prolonged exposure to television's heavily saturated, luminous colors might affect the colors we experience in dreams. Color perception, like other kinds of perception, relies in part on the matching of incoming data to pre-existing categories stored as engrams. As Gregory (1973, p. 125) points out, color perception is not dependent only on the stimulus of wavelengths and intensities, but also on expectations about the normal colors of objects. Because these expectations are influenced by geographical and cultural factors, there is reason to expect that they could also be influenced by continual exposure to television. If it is logical to assume that the same perceptual categories are exercised in dreams, then it is also reasonable to speculate that the colors of television may be affecting the colors we "see" in dreams.

Research addressing such psychophysiological effects of television is as yet in its infancy. Recently, Schafer (1978) has demonstrated the usefulness of television programs as a reliable stimulus for evoking event-related brain waves in research on attention and distraction. Schafer's findings promise applications of his research to content issues, such as violence, and for rating the interest value of program elements.

The advertising and television industries have been quick to exploit such research techniques. NASA's oculometer (which records eye movements of viewers) has proven useful in studies of character identification and role modeling (for example, Maccoby, Wilson & Burton, 1958), as well as of attention-direction in television commercials (Beller, 1978). EEG monitoring also is used for this purpose by firms such as NeoroCommunications Research Laboratories, Inc., in Danbury, Connecticut. Comparisons of EEG recordings during REM sleep and during television viewing of comparable content could be valuable in exploring the relationship between dreams and television experiences. Experimental research along these lines will be almost of necessity cross-cultural, in the light of the ubiquity of television in the United States. The growing use of television throughout the world makes such research urgent if it is to be done at all.

Another question arises from the characterization of D-state sleep as a third state of existence in addition to thinking sleep and wakefulness. Again, detailed comparisons of EEG records

of subjects during viewing and dreaming could reveal the specific nature of similarities in brain-wave patterns in the two states. It could be that television viewing is capable of stimulating a mental state in some "twilight zone" between waking and dreaming.

To move away from such flamboyant behaviorist speculations to matters of content, we might investigate the relationship between the concrete nature of dream perceptions and the perception of characters and objects portrayed on television. To what extent do viewers perceive things seen on television as concrete individuals as opposed to representatives of categories? The answer to this question may have exciting implications for the development of visual literacy. More specifically, a better understanding of children's and adults' perceptions of characters as types or as individuals could refine notions of television's possible cognitive and modeling effects. Those refinements, in turn, could indicate reliable means of training children to be more critical (in the best sense of that word) viewers, and, thereby, more consciously skillful viewers.

Several additional critical issues come to mind when we compare dream content to television content. For example, despite the fact that most television programs (like dreams) tend to be action-oriented, the bulk of television's content (again, like dreams) is not memorable. On the average, adults spend twenty per cent of their sleeping time in the D-state. In the United States, they spend at least twenty per cent of their waking time

watching television. Is it reasonable to expect that a high percentage of what we see in either will be highly stimulating and exciting? Probably not. Moreover, would it be desirable for very much of either to be really exciting? Shades of James Olds' (1956) rats, exhausted from orgies of electrical stimulation to the pleasure centers of their brains, come to mind.

The formulaic nature of dreams may be similarly instructive. Both dreams and television programs occur in regular cycles according to more or less strict rules of timing and sequencing. In addition, the manifest and latent content of each occurs in patterns of recurrent symbols and events. In these recurrent images, it is possible to detect the preoccupations of the dreamer.

Dreams, to the extent that they are the output of individuals' memory systems, allow people to work through (to use a clinical phrase) the anxieties created by their preoccupations. Television has been castigated (by Grotjahn [1973], for example) because it fails to provide enough content that facilitates the process of working through tensions via visual participation. Though few people would quarrel with more attempts to provide individual viewers with profoundly emotional symbolic experiences (catharsis in the Aristotelian sense), this criticism misses the point.

More important than a projective device for the individual, television content is largely the output of collective memory. Its prime function in this context is to address cultural and social preoccupations, which may or may not coincide with personal

ones. If dreams provide the individual with forms for "affective schemas" and generate ideas on the level of "individual truth" (as Jones [1978, p. 165] suggests in his extension of the Piagetian interpretation of play), then television serves a similar function on the level of "collective truth." Functions such as agenda-setting and status-conferral fit comfortably under this rubric. No matter which terms we ascribe to these functions, however, television's responsibility is awesome indeed.

As the human perceptual, nervous, and cultural systems create a world, so too does television create a world and deliver it to us daily. We do not know the precise connection between the process of dreaming and the content of dreams, and yet questions about the connection are worthy of research. Just as worthy are similar questions about the content of television: Whose reality appears on the television screen? How useful is it? To whom is it useful? These are the questions of social research, power structure research, and policy research. They are important questions in their own right, and they take on added weight in the light of possible psychoneurological effects. As Gregory (1973, p. 175) reminds us, the artist reproduces the image on his own retina, not the world.

Certain developmental effects of exposure to images projected on the electronic dream screen are well established. Studies of television's role in character identification, attitude formation, and role modeling in children need not be recounted

here. What is not established is the extent to which television performs other functions normally attributed to fantasy for children or adults. For example, dreaming's buffer-dumping (clearing day residue, in clinical terminology) and synthesizing (reorganizing) effects are conceivable functions of news programming. (News programs, of course, contain as much myth, fantasy, and collective dream as any fictional mode of presentation.) An important additional function of television news, as we finally have come to recognize, is entertainment. At least one dream researcher (Jones [1978]) acknowledges the entertainment value of dreams and their recall. Inasmuch as most television programs have entertainment as their primary purpose, and inasmuch as entertainment appears again and again as the most important gratification sought by television audiences, it is essential that we have a better understanding of the process and function of entertainment and any possible connections between television and dreams as diversions.

The visual components of television and dreams suggest yet another area of inquiry. Both experiences are intensely visual, and they both seem to exercise the right hemisphere of the brain more than the left. Three questions arise from this comparison. Is it possible that television in all its visual vividness is capable of bypassing conscious processing and implanting images directly into the unconscious? The assertion of this capability is a frequent theme in popular media criticism.

Key's (1973) "subliminal seduction" hypothesis is tantalizing, though much more rigorous testing is still needed.

A more positive approach to this issue is implicit in a second question: Is there a sense in which television viewing is a creative experience akin to dreaming? We know that subjects deprived of REM-sleep go on "dream binges" to make up for the deprivation. People who are engaged in creative activities during the day need less sleep (and less dreaming) than people whose work is not creative. The question that comes to mind is whether heavy television viewers dream less than other people. Current dream research techniques could answer this question easily. If heavy television viewers dream less than light viewers, it is as conceivable that television meets a creative need as it is conceivable that it deprives people of creative experiences.

This line of research suggests yet another interesting question. "Too much" dreaming produces fatigue because dreaming is an exhausting activity. "Too much" television viewing also produces fatigue. Could it be that television viewing is not the passive activity that many have thought it to be? After all, sleeping was for a long time regarded as a state of suspended mental activity. We know now that this is grossly untrue. It could be that the "narcotyzing dysfunction" hypothesis deserves reinterpretation in the light of dream research. If television can cause overstimulation, then what is the nature of the

overstimulation, and what are its consequences?

The video medium, it appears, is as capable of abetting creativity as it is of suppressing it. For some time, engineers have been using computer-generated video projections as aids to visualization. In this application, computer and video technology supplement, or assist, right-brain processing. Computer-generated graphics are commonplace too in broadcast television. They are often used to create startling and challenging visual effects. Similar stimulation of right-brain functions occurs with rapid cutting, novel juxtapositions, and other conventions of television art. Hobson and McCarley (1977) speculate that symbol formation and the bizarre juxtaposition of sensations in dreaming may be a reflection of heightened simultaneous activation of multiple sensory channels. Thus television may have the unrecognized potential to force us into creative thinking about human problems that now seem overwhelming. The key to this potential appears to be the enhancement of right-brain functions.

Taken together, the visual and auditory channels imitate the integration of right-and left-hemispheric functioning discussed earlier. Television invites the viewer to use visual and verbal, simultaneous and linear, processing in the vigorous exercise of the whole brain. The talking dream screen in the living room is, in this sense, a model of the talking dream screen in our heads. In this paper I have posed a few questions and, I trust, a good many answers await the diligent.

Human behavior requires that both left-brain and right-brain processing be well developed. Many observers--Ornstein (1975), Jaynes (1976), McLuhan (1964), Jung (1968)--have noted that western cultures foster left-brain functions at the expense of right-brain functions (and people whose talents lean toward right-brain skills). We can no more do without the visual arts than do without physics. As Bruner says, the left hand teaches the right. Television's potential for facilitating the redemption of right-brain skills must be explored by scientists. But for safe-keeping, I must agree with Grotjahn (1973, p. 14) that "television should not be put in the hands of old-fashioned teachers, nor should it be given into the hands of psychoanalysts. It belongs in the hands of the artist."

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